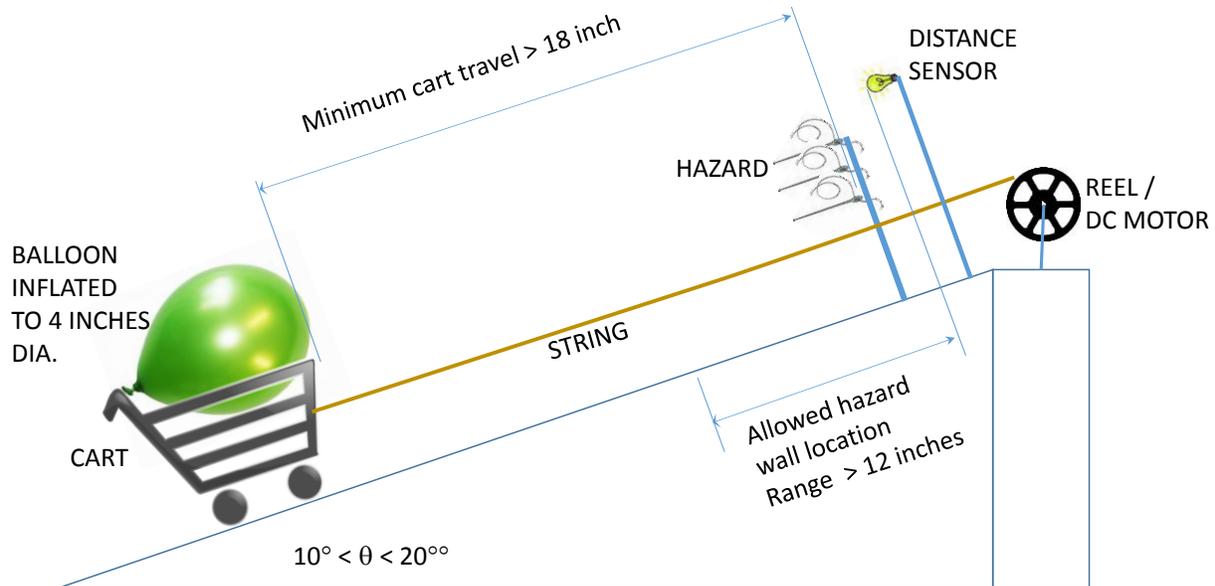


ME 439 PROJECT #1

OVERVIEW:

You will design a ramp / cart system that will use a motor to draw a cart carrying a balloon up a ramp toward a wall of sharp pins. Using a distance sensor, you will stop the cart as close as possible to the hazard (wall of nails) without touching it and popping the balloon. The diagram below illustrates the project platform:



RULES:

The overall goal of the project is to get you comfortable with interfacing with real hardware via a microcontroller, and real actuators / sensors. For this project, the closer you can get your cart to the hazard without popping the balloon, the better. In addition to this primary goal, you should follow these rules when carrying out your design:

1. You and your group will provide everything required for the project to function including the ramp platform, cart, balloon, and wall of spikes.
2. You must use an ARDUINO microcontroller to read values from a distance sensor (input) and automatically stop the motor (output) based on some criteria that corresponds to the balloon being too close to the hazard.
3. You must demonstrate that the hazard (wall of spikes) is sharp enough to pop a balloon upon minimal contact; do not attempt to use very dull nails. No part of the cart may come in contact with the spikes. Prior to your demonstration, you should show me that your wall does in fact pop a balloon, i.e. bring extra balloons.
4. The Balloon does not need to be inflated too large; inflating to the size of a large navel orange approx. 4 inches in diameter should be suffice
5. The ramp platform does not need to be large, however the cart needs to travel more than 18 inches before encountering the wall. The angle of the ramp from horizontal is not

important, but the cart should be able to reverse down the ramp by simply reversing the motor direction, and move under the influence of gravity.

6. The speed of the cart is not important - only the final distance between the balloon and the spikes is the metric of interest
7. A push of a momentary button should begin the demonstration and start pulling the cart up the ramp. Once the balloon reaches its final state (as close as possible to the wall), the cart should automatically stop and hold its position indefinitely so that one can manually measure the distance between the wall and balloon using a ruler. Pushing the button again, or pushing a separate button, should reverse the motor and reset the cart to the starting position once pressed. These will be the only two times you are permitted to interact with your project once your demonstration begins. Once the cart begins moving in either direction, you may not interact with any part of your system.
8. Your hazard (spike wall) should be removable and easily mountable along the ramp (Velcro?). You can provide the ME 439 Lab instructor with a clearly-marked range on your ramp on which he can place the spike wall. The instructor will arbitrarily choose a location within your specified range at random for the position of the wall on the demonstration day. This constraint may involve relocating the sensor to a different location from that shown on the diagram above.
9. You will have three (3) attempts to get as close as possible to the wall without popping your balloon.

LAB WRITE-UP:

Each group (no more than 2 people per group) should hand in one (1) written lab report on the day of the Lab 1 demonstration. There is no minimum or maximum length, but you should include at least the following sections:

1. Problem statement - what you are trying to achieve
2. Project platform description - a description of all hardware elements used in your project including controller, sensors, actuators, and raw materials used in the construction of your platform. Perhaps a picture / figure would be a useful visual here.
3. A description of the overall algorithm and approach you took to solving the problem.
4. Your results / conclusions / problems encountered - were you successful?
5. An appendix with your actual code used, part numbers for components, and any other relevant information

GRADING:

Function (stopped w/in 5 cm on hazard)	10 pts
Constraints (followed all rules)	20 pts
Lab report	20 pts
Total	50 pts

Bonus (to the group(s) who stop the cart with the smallest distance between their balloon and hazard) 10 pts. possible counted toward the total of 50 pts above.

SAFETY:

This project is meant to stimulate creativity. If at any time the ME 439L Instructor deems the project to be unsafe, he will pull the entry from the demonstration. Thus, when building the hazard,

make sure that it is not a safety threat. No flying objects will be allowed or permitted. Students should wear safety glasses when demonstrating the project.